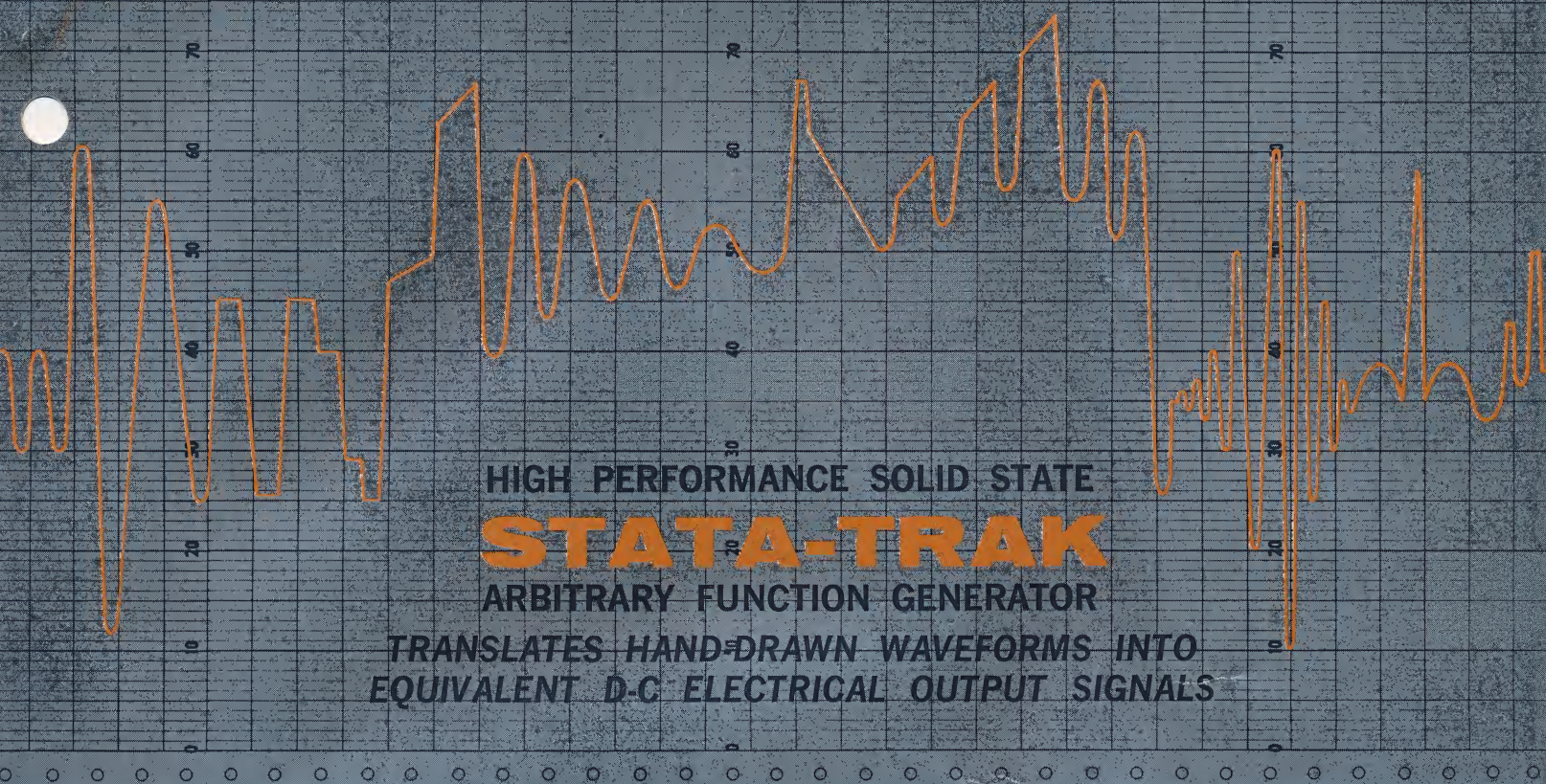


**NOW!**

CREATING SIMPLE OR COMPLEX ARBITRARY WAVEFORM PROGRAMS IS AS EASY AS DRAWING A LINE...



HIGH PERFORMANCE SOLID STATE

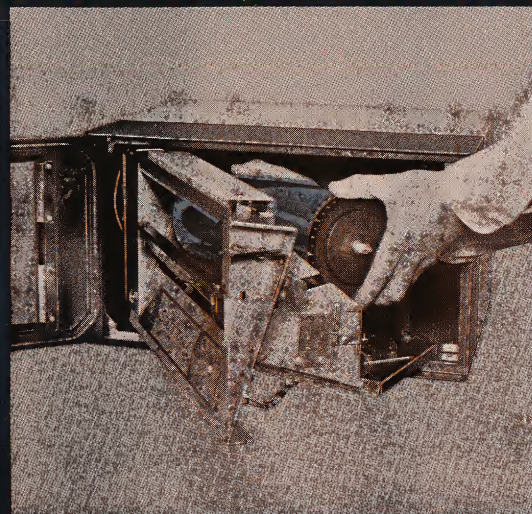
**STATA-TRAK**

ARBITRARY FUNCTION GENERATOR

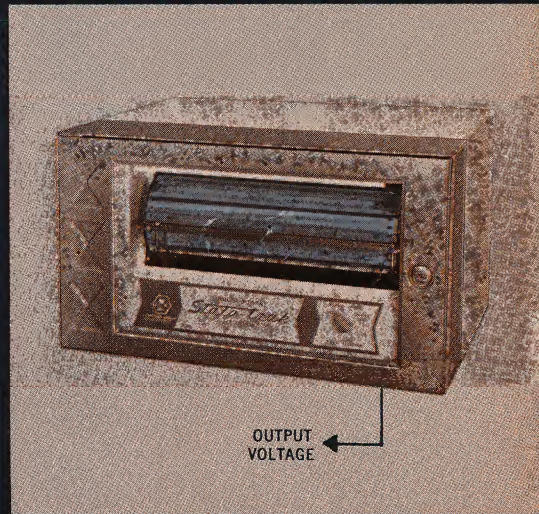
TRANSLATES HAND-DRAWN WAVEFORMS INTO  
EQUIVALENT D-C ELECTRICAL OUTPUT SIGNALS



Draw desired single-valued time functions as simple or complex waveforms on STATA-TRAK program chart.



Attach chart to program drum, and mount in STATA-TRAK Arbitrary Function Generator.



Drum rotates chart past program sensor; STATA-TRAK translates hand-drawn waveforms into equivalent electrical output signals.

This unique new concept in function generators (patent pending) is capable of generating infinite combinations of continuously repetitive waveforms ranging from the simplest ramp to the most complicated combination of curved-and-linear, variable amplitude and duration functions in the form of direct electrical output signals.



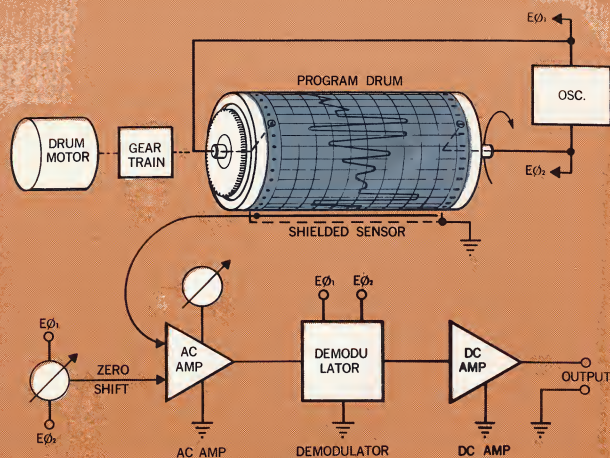
**CONTROLS DIVISION**  
RESEARCH, INCORPORATED  
MINNEAPOLIS 24, MINNESOTA



**STATA-TRAK** is an electronic instrument which directly translates hand-drawn arbitrary single-valued time functions into equivalent electrical output signals.

**STATA-TRAK** provides the means for generating arbitrary electrical functions ranging from single linear ramps to complex continuously repetitive waveforms combining variable amplitudes, durations, slopes and pulse sequences. STATA-TRAK'S easy-to-use electrostatic program-sensing system eliminates the complicated electronics and piece-by-piece synthesis of fundamental and harmonic frequencies usually required to construct complex waveforms by biased-diode methods.

## FUNCTIONAL DIAGRAM



## HOW IT WORKS

A waveform is drawn on STATA-TRAK metallized program-chart paper with an electrical etching stylus. The etching process removes a fine line of metal from the chart, dividing the surface into two electrically-isolated conductive segments. The chart is subsequently mounted on a program drum, inserted into STATA-TRAK, and rotated at a preselected speed past the stationary probe, as shown in the diagram at the left.

The sensing electrode is a fine wire depressed into a milled slot in the program sensor surface adjacent to the drum. The sensor spans the active width of the chart and is spaced a fixed distance from the drum surface. The two metallized chart segments are energized with oppositely-phased high frequency voltages from the a-c oscillator. These voltages are capacitively summed by the sensing electrode in linear proportion to the division of the chart established by the waveform line. The total capacity between electrode and chart surface is held constant by the fixed sensor-drum spacing. If the waveform line divides the chart surface into two equal segments, the capacity between each segment and the electrode is equal and the voltages cancel. Electrical zero can, however, be shifted in either direction using the zero shift potentiometer.

The electrode is connected by a shielded wire to the input of a solid state a-c amplifier. A span control on this amplifier allows an adjustment between the plotted amplitude of the waveform and the subsequent output of the STATA-TRAK. A phase-sensitive demodulator converts the a-c amplifier voltage to an equivalent d-c voltage accurately representing the hand-drawn program waveform. A d-c amplifier provides  $\pm 5$  volts output with an impedance of 500 ohms.



## IMPORTANT FEATURES

- |                                                  |                                        |
|--------------------------------------------------|----------------------------------------|
| 1 Metallized Program Chart                       | 8 Time-Base Motor                      |
| 2 Waveform Program Line                          | 9 Solid-State Circuitry                |
| 3 Non-Contacting Program Sensor                  | 10 Span Control                        |
| 4 Recessed Lock                                  | 11 Zero Shift Control                  |
| 5 Mode Switch — Off, Remote, Hold, Run Positions | 12 Swing-Out Chassis — for easy Access |
| 6 Dust-Tight Cabinet                             | 13 Contact Pins                        |
| 7 Program Drum                                   | 14 Micro-Switches                      |
|                                                  | 15 Spare Contact Pins                  |

## STATA-TRAK ADVANTAGES

**DIRECT DATA CONVERSION** — Plotted waveforms are converted directly to equivalent electrical signal.

**RECTILINEAR PLOTTING** — 11-inch plotting resolution on amplitude scale, 13 1/2-inch on time scale.

**REUSABLE PROGRAMS** — Program sensor does not contact chart; no noise or chart wear.

**ADJUSTABLE TIME BASE** — Drum speed can be adjusted over wide limits by gear and/or synchronous-motor changes.

**VARIABLE SPAN** — Span potentiometer allows adjustment between plotted amplitude and equivalent electrical signal.

**VARIABLE ZERO** — Zero potentiometer allows shifting of electrical zero over full chart width.

**NO OVERSHOOT** — Precision solid-state circuitry and stationary sensor design prevent both overshoot and velocity errors. No servo system.

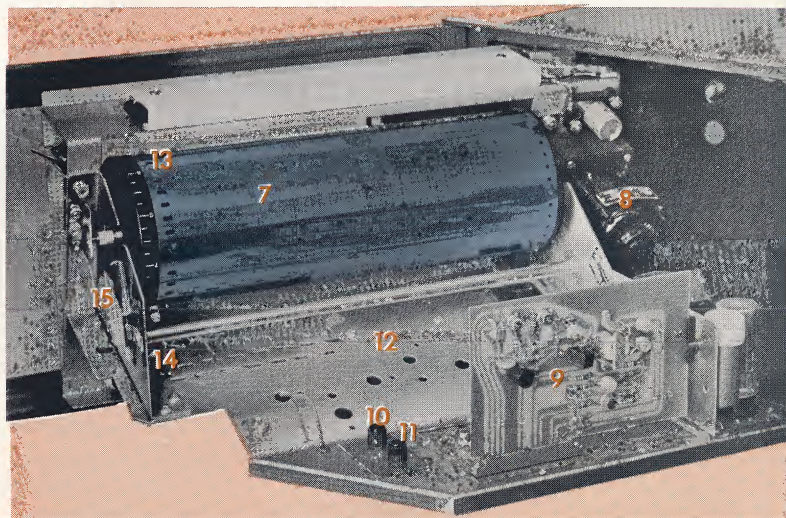
**REPETITIVE WAVEFORMS** — Plotted waveform repeats with each drum revolution.

**SELF CONTAINED** — All necessary circuitry contained within STATA-TRAK swing-out chassis. Connect to 115 VAC, 60 cycles.

**HIGH RESPONSE** — Electronic response flat to 1700 cps.

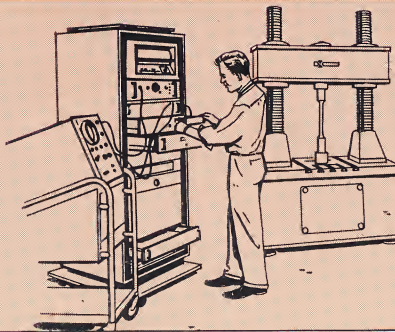
**RUGGED INDUSTRIAL CONSTRUCTION** — Heavy gauge steel enclosure with gasketed cast door for resistance against shock, dust and vibration.

**REMOTE PROGRAM HOLD** — Program drum can be stopped at any point in waveform cycle, holding existing voltage level.



## SERVO SYSTEM ANALYSIS:

STATA-TRAK Waveform Generators make the task of investigating and analyzing servo-systems and components simpler, faster and more accurate. Any program of single-valued time functions can be drawn and faithfully reproduced as a d-c output signal. Need even more complexity? Use two STATA-TRAKS, one for X axis and one for Y, and sum the combined output.



## MATERIALS AND STRUCTURES

**RESEARCH:** Random, highly repeatable fatigue test programs are essential to critical evaluation of materials and structures. STATA-TRAK input through high-response servo-controllers provides arbitrary and cyclic programming of load or strain to automatically simulate stresses experienced by a material or component in actual or accelerated use.







**MEDICAL RESEARCH: STATA-TRAK** can be a valuable asset in simulating physiological data in medical research. Normal and abnormal "brain waves," electrocardiograph waveforms, nerve and muscle potentials can be simulated and endlessly and quickly repeated. Research time can be measurably reduced and accuracy improved with STATA-TRAK Waveform Generators.

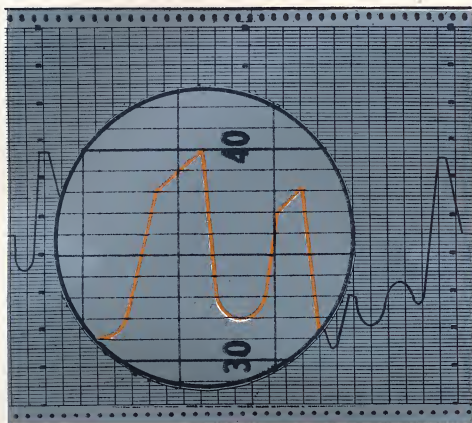


**VIBRATION AND SHAKER-TABLE DRIVER:** STATA-TRAK performs ideally as the waveform generator and driver for vibration and rate tables of all sizes and capacities. STATA-TRAK can also be utilized to produce compensating waveforms sometimes required to offset overshoot characteristics of vibration equipment which may be encountered in certain applications.

## PROGRAM CHART PREPARATION

Programs are prepared quickly and easily by "drawing" desired waveforms on metallized STATA-TRAK chart paper with an electric Etching Stylus, used like a pencil. This paper is coated with a very thin but durable conductive metal film on which precisely divided coordinate scales are printed.

Drawing the electric stylus over the metallized surface (as one would draw with a sharp pencil on ordinary graph paper) produces a fine red line where the contrasting backing paper is exposed by evaporation of the metal film from the path of the stylus. The ease with which this narrow (.015-inch) line can be precisely plotted is a major factor in the accuracy of the STATA-TRAK programming system.



Model ES 5140 Etching Stylus is energized by a small d-c power supply that operates on 110-volt, 60-cycle current. Contact is made with the paper through the power supply base by merely resting the power supply on one corner of the chart. The circuit is completed by touching the tip of the stylus to the metallized paper, where a small arc evaporates the metal coating from the paper. Standard drafting triangles and curves may be used as guides.



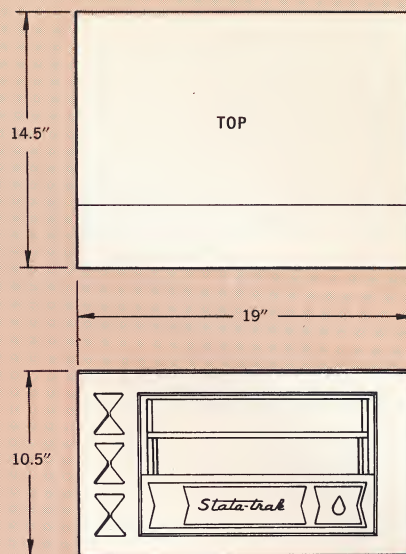
In this illustration of a complete program chart, a full-size blow-up shows the actual width of program line commonly used.

| CHART SPEED DATA                |                 |                 |                 |                 |                  |                  |                 |                               |                  |                  |                 |                 |                   |              |             |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|-----------------|-------------------------------|------------------|------------------|-----------------|-----------------|-------------------|--------------|-------------|
| GEAR TRAIN SS - SLOW SPEED [SS] |                 |                 |                 |                 |                  |                  |                 | GEAR TRAIN HS - HI SPEED [HS] |                  |                  |                 |                 |                   | CHANGE GEARS |             |
| [2] DRUM MOTOR                  | [4] DRUM MOTOR  | [10] DRUM MOTOR | [60] DRUM MOTOR | [10] DRUM MOTOR | [60] DRUM MOTOR  | [300] DRUM MOTOR |                 | [10] DRUM MOTOR               | [60] DRUM MOTOR  | [300] DRUM MOTOR |                 |                 |                   | NO. OF TEETH | GEAR LETTER |
| IN / HR.                        | HR. / REV.      | IN / HR.        | HR. / REV.      | IN / HR.        | HR. / REV.       | IN / MIN.        | MIN. / REV.     | IN / MIN.                     | MIN. / REV.      | IN / SEC.        | SEC. / REV.     | IN / SEC.       | SEC. / REV.       |              |             |
| $\frac{3}{4}$                   | 18              | $1\frac{1}{2}$  | 9               | $3\frac{3}{4}$  | $3\frac{6}{10}$  | $\frac{3}{8}$    | 36              | $2\frac{1}{2}$                | $5\frac{4}{10}$  | $\frac{1}{4}$    | 54              | $1\frac{1}{4}$  | $10\frac{8}{10}$  | 16           | C           |
| 1                               | $13\frac{1}{2}$ | 2               | $6\frac{3}{4}$  | 5               | $2\frac{7}{10}$  | $\frac{1}{2}$    | 27              | $3\frac{1}{3}$                | $4\frac{1}{20}$  | $\frac{1}{3}$    | $40\frac{1}{2}$ | $1\frac{2}{3}$  | $8\frac{1}{10}$   | 24           | J           |
| $1\frac{1}{2}$                  | 9               | 3               | $4\frac{1}{2}$  | $7\frac{1}{2}$  | $1\frac{8}{10}$  | $\frac{3}{4}$    | 18              | 5                             | $2\frac{7}{10}$  | $\frac{1}{2}$    | 27              | $2\frac{1}{2}$  | $5\frac{4}{10}$   | 32           | K           |
| 2                               | $6\frac{3}{4}$  | 4               | $3\frac{3}{8}$  | 10              | $1\frac{7}{20}$  | 1                | $13\frac{1}{2}$ | $6\frac{2}{3}$                | $2\frac{1}{40}$  | $\frac{2}{3}$    | $20\frac{1}{4}$ | $3\frac{1}{3}$  | $4\frac{1}{20}$   | 48           | E           |
| 3                               | $4\frac{1}{2}$  | 6               | $2\frac{1}{4}$  | 15              | $\frac{9}{10}$   | $1\frac{1}{2}$   | 9               | 10                            | $1\frac{7}{20}$  | 1                | $13\frac{1}{2}$ | 5               | $2\frac{7}{10}$   | 48           | L           |
| $4\frac{1}{2}$                  | 3               | 9               | $1\frac{1}{2}$  | $22\frac{1}{2}$ | $\frac{6}{10}$   | $2\frac{1}{4}$   | 6               | 15                            | $\frac{9}{10}$   | $1\frac{1}{2}$   | 9               | $7\frac{1}{2}$  | $1\frac{8}{10}$   | 48           | F           |
| 5                               | $2\frac{7}{10}$ | 10              | $1\frac{7}{20}$ | 25              | $\frac{27}{50}$  | $2\frac{1}{2}$   | $5\frac{4}{10}$ | $16\frac{2}{3}$               | $\frac{81}{100}$ | $1\frac{2}{3}$   | $8\frac{1}{10}$ | $8\frac{1}{3}$  | $1\frac{62}{100}$ | 50           | G           |
| 6                               | $2\frac{1}{4}$  | 12              | $1\frac{1}{8}$  | 30              | $\frac{9}{20}$   | 3                | $4\frac{1}{2}$  | 20                            | $\frac{27}{40}$  | 2                | $6\frac{3}{4}$  | 10              | $1\frac{7}{20}$   | 64           | M           |
| 9                               | $1\frac{1}{2}$  | 18              | $\frac{3}{4}$   | 45              | $\frac{3}{10}$   | $4\frac{1}{2}$   | 3               | 30                            | $\frac{9}{20}$   | 3                | $4\frac{1}{2}$  | 15              | $\frac{9}{10}$    | 72           | N           |
| 10                              | $1\frac{7}{20}$ | 20              | $\frac{27}{40}$ | 50              | $\frac{27}{100}$ | 5                | $2\frac{7}{10}$ | $33\frac{1}{3}$               | $\frac{81}{200}$ | $3\frac{1}{3}$   | $4\frac{1}{20}$ | $16\frac{2}{3}$ | $\frac{81}{100}$  | 50           | B           |
| 12                              | $1\frac{1}{8}$  | 24              | $\frac{9}{16}$  | 60              | $\frac{9}{40}$   | 6                | $2\frac{1}{4}$  | 40                            | $\frac{27}{80}$  | 4                | $3\frac{3}{8}$  | 20              | $\frac{27}{40}$   | 64           | H           |
| SPEED RANGE I                   |                 | SPEED RANGE II  |                 | SPEED RANGE III |                  | SPEED RANGE IV   |                 | SPEED RANGE V                 |                  | SPEED RANGE VI   |                 | SPEED RANGE VII |                   |              |             |



## ADDITIONAL TYPICAL APPLICATIONS

- Replacement for Waveform Synthesizers
- Simulator for Waveform Analysis and distortion studies
- Function Generator for Analog Computers
- Testing and checkout of telemetry system components
- Simulator applications requiring high-response analog input
- Arbitrary Programmer for quality control check-out of components



## PERFORMANCE DATA

|                              |                                                                                                                                                                                                                                                 |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| WAVEFORM TYPES               | Infinite. Hand-drawn single-valued time functions — complex linear, curved and standard waveform combinations.                                                                                                                                  |
| PROGRAMMABLE FREQUENCY RANGE | D-C to 160 cps with no overshoot or velocity lag (determined by drum rotation speed and intervals at which functions are plotted on 13½" STATA-TRAK program chart paper. Recommend plotting max. of 8 cycles per inch for optimum performance). |
| SYSTEM FREQUENCY RESPONSE    | D-C to 1.7KC                                                                                                                                                                                                                                    |
| PHASE LAG, OVERSHOOT         | None (direct electrostatic pickup — no servo system).                                                                                                                                                                                           |
| PROGRAM SENSOR               | Electrostatic, non-contacting. No program chart wear.                                                                                                                                                                                           |
| CONTROLS:                    |                                                                                                                                                                                                                                                 |
| ZERO SHIFT                   | Enables operator to shift zero level of output signal in either negative or positive direction.                                                                                                                                                 |
| SPAN                         | Enables operator to adjust the range of output signals to correspond to the span of the charted program.                                                                                                                                        |
| HOLD                         | Permits operator to stop program at any point while retaining systems at operational status quo. Switching to RUN position continues operational cycle from HOLD point.                                                                         |
| PROGRAM CHART PREPARATION    | Waveforms easily programmed with Electric Etcher on STATA-TRAK chart paper. Usable programming area 11" W x 13½" L (circumference of drum). Available in 50-ft. rolls (MCR 10-R5000 paper). See Data sheet 502.14                               |

## SPECIFICATIONS

|                       |                                                                                                                                                                                                    |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| RESOLUTION            | Infinite.                                                                                                                                                                                          |
| LINEARITY             | ± 2%                                                                                                                                                                                               |
| ACCURACY              | ± 2% full scale.                                                                                                                                                                                   |
| OUTPUT                | ±5 volts. Other ranges available. Control wiring is connected to barrier strip inside cabinet.                                                                                                     |
| TIME BASE             | Adjustable from ¾" per hour to 20" per second by changing motor and/or gears. See table "Chart Speed Data." Higher speeds optional.                                                                |
| AMPLIFIER             | Solid-state circuitry on plug-in board.                                                                                                                                                            |
| MAX. OUTPUT IMPEDANCE | 500 ohms nominal                                                                                                                                                                                   |
| LINE VOLTAGE          | 115V a-c, 60 cycles, .3 amperes                                                                                                                                                                    |
| DRUM ROTATION         | Continuous.                                                                                                                                                                                        |
| DRUM DRIVE            | OPTIONAL:<br>1) Preset Counter to shut down STATA-TRAK automatically after predetermined number of repetitive cycles.<br>2) Microswitch Trip Tabs or Reed Switches to limit drum rotation to 360°. |
| WEIGHT                | Synchronous motor through precision gear train.                                                                                                                                                    |
| DIMENSIONS            | 50 LBS.<br>10½" high, 19" wide, 15" deep.                                                                                                                                                          |

ORDERING  
EXAMPLE

FGE 5124 -SS



GEAR TRAIN

-60



DRUM MOTOR

BA



GEAR SET

R-I CONTROLS designs and manufactures complete temperature, power and process-control equipment and systems. For those who are building or implementing their own facilities, the following related modular units are offered:

PROGRAMMERS — DATA-TRAK Curve-Followers, PREKORDER Programmer-Recorder-Controllers. (Request Bulletin 502)

COMBINED TEMPERATURE-POWER CONTROLLERS — High-performance THERMAC Solid State Controllers. (Request Bulletin 501)

POWER REGULATORS — Ignitron, Thyatron and Solid-State Power Regulators. (Request Bulletin 503.2)



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